

CLINICAL LECTURE

ON THE TRANSPLANTATION OF SKIN.

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TRANSPLANTATION of skin is a subject of great scientific interest and practical value. Though the possibility of transplanting skin has been known but a short time, it has largely engaged the attention of surgeons; and most of those who have experimentally tried it have been highly gratified with the results which they have obtained, and have become warm advocates of this mode of treatment. It is of interest in every-day surgery, as well as in the more striking forms of autoplasty.

Ulcers thrust themselves upon the care of all surgeons, the private practitioner, the parish and club-doctor; while the most aggravated and chronic cases continually come under our notice as hospital surgeons. To all, a means of decided and rapid cure, such as transplantation of skin promises, is a matter of congratulation. Like many other important advances in science, there have been for a long time indications strongly pointing to it. The vital power of transplanted skin as a centre of growth has been repeatedly proved in cases of total detachment, as well as in the remarkable results of plastic operations. Where a large portion of skin is dissected from the subjacent tissues, its connexion with the body is maintained only by a neck of integument (which is generally twisted); it is transferred to a raw new surface; and yet in most instances it lives as well in its adopted as in its natural habitat. We have all also observed the great value which is possessed, in a large ulcerated surface, by any portions of true skin, however small; and the remarkable manner in which these prove to be, as it were, oases in the desert, and spread their circles of cicatrisation over the granulating surface to meet the circumferential, and greatly expedite the cure. It appears that Dr. Frank Hamilton of New York suggested this plan as early as 1847, but put it into operation for the first time in 1854 in the person of Horace Driscoll, who had lost a large portion of the integument of his leg by the fall of a heavy stone upon it. After the lapse of fifteen months, it was apparent that the ordinary processes of nature were insufficient for repair. The integument was taken from the calf of the opposite leg, but was wholly inadequate to cover the entire sore. In ninety days, cicatrisation was complete; and it has remained so until the present day. In the result, it was observed that the new piece of skin had grown from its circumference in every direction, so that it was in the end nearly twice its original size. (*New York Medical Gazette*, August 20th, 1870.) Dr. Hamilton proved that transplanted skin would adhere to granulations; that the piece engrafted need not cover the ulcer, but would develop cicatrisation for its margin. He did not, however, discover that the graft might be wholly separated before insertion. It was reserved for M. Reverdin of Paris recently to demonstrate that portions of skin of various sizes might be removed from any part of the body, and engrafted upon a granulating surface; that they would live, act as centres of cicatrisation, give new vigour to the healing part, materially hasten recovery, and even bring about restoration in some ulcers which, from their size, could otherwise never have been healed.

M. Reverdin's paper on Epidermic Grafting was read before the Surgical Society of Paris in December of last year, and published in the *Bulletin* of the Society for that year, and also in the *Gazette des Hôpitaux* for January 11th and 22nd, 1870. Mr. George Pollock heard of M. Reverdin's experiments in May last, and immediately tried the treatment on a most suitable case, in a child eight years of age, who had been in St. George's Hospital for three months and a half with a very extensive burn of the right thigh, of more than two years' duration. The ulcerated surface extended from the buttock to the knee; it was broad above, narrow and pointed below. The progress and success of this case attracted considerable attention, and the practice was soon adopted in most of the London and several provincial hospitals.

In applying this treatment to ulcers, we must bear in mind the two leading objects of treatment—firstly, rapidity of cure; and secondly, permanence of cicatrisation. The following points are of importance, to consider when we are about to operate: the state of the ulcer;

the size and number of pieces to be grafted; how near they should be placed; whether the whole or only part of the cutis should be inserted.

It is necessary that the granulating surface be in a healthy or tolerably healthy condition. This was insisted on by Mr. Pollock and Mr. Lawson in an interesting discussion at the Clinical Society on November 11th, and has been felt to be an essential by all who have practised the operation; and, where failure has followed skin-grafting, an ill-conditioned state of ulcer has generally been the cause. I feel that, where there is any marginal cicatrisation, or disposition to form the same, grafting may safely be practised, and the process from the margin will rapidly advance.

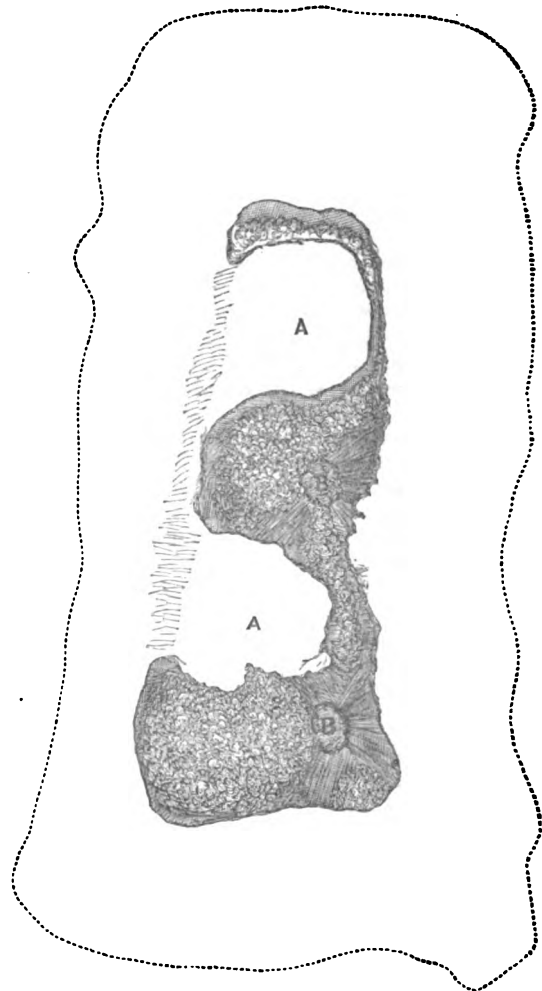
With regard to the size of pieces of skin and the depth of true skin to be used, it has been clearly shown that those employed by M. Reverdin and Mr. Pollock and many others, of the size of a millet-seed or an oat, whether including the whole or only part of the cutis vera, answer admirably; while the minutest subdivisions, as carried out by Mr. Dobson at the Bristol General Hospital in some striking cases which he brought before a meeting of the Bath and Bristol Branch of the Association on October 27th, set up rapid cicatrisation; and portions of entire skin a quarter of an inch in diameter also answer well. From these facts, it is evident that all that is essential is the papillary layer of cutis, no matter how small, capable of developing cuticle, and therefore cicatrisation. But, in dealing with individual cases, I feel it right to bear in mind the size of cicatrix which will result, and the strain to which it will be subjected. While, therefore, on the grounds of economy of skin and consideration for the patient, we should use little skin in such ulcers as will not be subjected to great strain, yet in those which will, as large ulcers on the leg, which, after being healed, frequently disappoint by breaking out again, it is most evident that to transplant a number of fair sized portions of entire skin, which will retain certainly their elasticity, and so, by their individual stretching, relieve the tension of the whole surface, is the most likely to be permanently successful. Transplanted skin does not retain its perfect integrity and function, as does skin employed in Taliacotian operations; since, in the first place, we cut it so close to its under-surface, in order to avoid fat and areolar tissue, that we must cut through most, if not all, the sweat-glands and hair-bulbs; and, secondly, the new piece sheds its epidermis, and for a time takes on the appearance of granulations, and, when cicatrisation has taken place, has more the smooth look of a cicatrix than the furrowed and soft appearance of true skin. Yet it contains its elastic tissue, is thicker in consistence, and has a more natural feeling and appearance than the cicatrix formed around it. Experiments have shown how little may be used with good results; they will yet show, I feel sure, that far larger portions may be employed than have yet been, and with great advantage, as, for instance, in relieving contractions from burns. I have now under treatment a case of this nature, in which I expect to show that a piece of the size of a penny will succeed, and give elasticity in a situation where it is greatly needed—namely, in the bend of the elbow. It is clear that, the greater the number of centres, the more rapid the cure must be, and the firmer the cicatrix; but I am inclined to think that, in a large surface, the same sized piece of skin would prove more useful if employed in a series of graftings than if distributed in exactly the same spots at one operation; for I am convinced that each series gives fresh life and vigour to the whole surface. For the same reason, since each graft is found capable of developing a cicatrix from a quarter of an inch to an inch in diameter, it is wise to insert the portions of skin from an inch to two inches apart, and subsequently place fresh points between these.

In operating, a portion of skin is pinched up in a forceps, or between the finger and thumb, and removed, either in the entire thickness or in part: it is essential on the one hand that no areolar tissue and fat, on the other that the papillary layer of cutis, be removed. The granulations, if quite healthy, need only be clean; if not quite bright and active, they are slightly incised or scratched; and, when bleeding has stopped, the graft is laid upon the surface. The portion removed is easily cut up, if desired, on the thumb-nail, and each portion can well be applied with the point of the scalpel. Some use a narrow strip of ordinary plaster, some transparent isinglass plaster, others Lister's lac-plaster. I have used these, and also a strip of gutta-percha tissue, which holds the portions of skin firmly in place, and, being transparent, enables one to see, while stretching it across, that the grafts do not slip. Over these, strapping, water-dressing, or any lotion suitable to the state of the granulations, should be applied; then a compress of cotton-wool, retained by a bandage, rather firmly applied, to insure close adaptation of the grafts to the granulations; the wool also serves to keep the grafts warm. I feel it wise to avoid ointments in the early dressings, as particles of grease might insinuate themselves beneath the transplantations and separate them. Unless there be copious suppuration, it is well not to disturb

the dressings till the second day; the appearance then presented is the epidermis of the graft lying free on the granulation dressings, or on the graft; if spread out, it shows the original size of the graft, which now is contracted and pale. During the next few days, the graft becomes vascular, and looks very like the surrounding granulations, and is nearly lost to view unless it be of some size, when it appears as a raised mass. It is difficult, and sometimes impossible, for even the operator to distinguish the grafts, if small, for the first seven to twelve days. The first indication of activity is a faint blue cicatrising aspect in the site of the graft; and I also observe, if the graft be near the circumference, a line of cicatrization running from the circumference to the graft, and one from the graft to the circumference, which unite and increase to a band, and so increase again the cicatrix-producing margin; in fact, these lines shoot out in various directions to any near margin or points, and thus in time may divide an ulcer into a series of smaller ones. One fact of great importance and value, and which shows the remarkable influence of the transplantations on the whole ulcer, is the rapidity with which cicatrization from the margin proceeds directly the grafts have established themselves, and even before they show much cicatrix of their own. Mr. Couper observed the same fact in a case under his care in the London Hospital, but remarked that he was not prepared to consider it more than a remarkable coincidence. I, however, feel it to be one of the most valuable immediate effects of transplantation, that the grafts act as natural stimulants to the ulcer generally, and arouse renewed energy in the marginal cicatrising edge, wearied with its previous almost hopeless exertion. These views I may well illustrate by the narration of the following case.

John Dando was admitted last April into the Bristol Royal Infirmary under my care with a very large syphilitic ulcer on the right leg, extending from an inch below the knee to an inch above the ankle-joint, and occupying the whole anterior and both lateral aspects of the leg, leaving only a band of entire skin behind, one inch wide below, but wider over the calf. The ulcer was extremely uneven and unhealthy. By carbolic lotion, black and yellow wash, and nitrate of silver lotion, successively, and scruple doses of iodide of potassium internally, continued for some time, a healthy granulating surface was established, which cicatrised and did well until the ulcer was reduced about one-third in size. Then the healing efforts became for a time exhausted, cicatrization entirely ceased, the surface put on an irritable appearance, and no progress was made for about three weeks. Under poultices and simple dressing, healthy granulations again appeared; and for two months strapping promoted good, but rather thin, cicatrization. In the beginning of October, all healing effort again became suddenly arrested; the cicatrised edge remained, though no cicatrization proceeded; and granulations were present, though pale and unpromising. On October 13th, I removed two portions of skin, each of the size of a fourpenny-piece, from the upper arm, one piece being the entire thickness of the skin throughout, the other the entire thickness in the centre, but sloping towards the edges; and, having scratched the granulations, placed these pieces upon them, one near the upper part of the ulcer, the other near the lower. The ulcer at the time was about six by three inches in size. I retained the grafts in place by narrow strips of plaster, and strapped the ulcer. On uncovering the surface two days afterwards, the epidermis of the grafts came away, but the grafts remained adherent, as pale, doughy-looking masses. During the next ten days, they appeared only as elevated patches of granulation, but the ulcer assumed a healthy appearance; and, by the time the grafts were surrounded by a feeble zone of cicatrization, we observed that the marginal cicatrization had proceeded with much greater rapidity than at its healthiest progress before, and that the ulcer was most contracted opposite each graft, so that these, which when inserted were an inch and a half from the margin, were now only about three-quarters of an inch from it. The granulations around each graft were very healthy, and cicatrization proceeded rapidly, but the space between them and below the lower island remained less active; and on November 9th, I removed from the left arm two portions of skin about the size of a pea, taking merely the papillary layer, and engrafted these, one between the two former grafts, the others below the lower original graft. These adhered, and presented similar appearances; in ten days, they were centres of cicatrization, and in two days longer showed lines of cicatrization passing from them to the margin. Near to them, and to the cicatrization surrounding the previous grafts, the whole ulcer contracted rapidly, and the first grafts joined the margin on one side; the product being of a whiter, more skin-like appearance, of a firmer, thicker consistence, and of a more elastic feeling than the surrounding blue cicatrization formed before grafting was commenced. At this stage the accompanying sketch was taken. Two days afterwards, the bands of cicatrization, extending to every point near the grafts, were wide firm bands, and the previously continuous granulated surface was subdivided by them into six small patches. I used small

grafts, including only a portion of the skin, on the second occasion, for the sake of comparing the result with the results of the larger portions of entire skin used for the former grafting. My only regret in this case is, that I did not adopt the plan of treatment some time previously, and thus provide the patient with a much stronger general cicatrix, including many portions of almost true skin capable of stretching and relieving tension, and therefore more likely to prove lasting.



Several cases of large ulcers of the leg successfully healed by this method have been reported under the treatment of Mr. Pollock in St. George's Hospital, Mr. Lawson in the Middlesex Hospital, Mr. F. Mason in the Westminster Hospital, Mr. C. Heath in University College Hospital, Mr. Bellamy in Charing Cross Hospital, Mr. Durham in Guy's Hospital, Mr. Kempe of Exeter, Mr. Dobson at the Bristol General Hospital, and others; also, of large ulcers resulting from burns, many of which were previously incapable of healing—all proving that we have now the means of healing ulcerated surfaces of unlimited size, provided they are or can be brought into a tolerably healthy condition. And, further, we shall be able to prevent those unsightly and distressing contractions of burns hitherto so frequent, and to remedy them in cases where they have occurred, and where it would be difficult to procure skin from the immediate neighbourhood for plastic operation; as, for instance, in a case which I have now under treatment in the Bristol Infirmary, of contraction of both elbows by firm bands, surrounded by large cicatrices, where a long neck would be needed, and the cicatrix of the surface on the forearm or arm, from which a sound piece of skin might be removed, would materially increase the tension of the old cicatrix. In these cases we are enabled to slit up the band, produce a large raw surface again, establish granulation, and

transplant freely. As I observed before, I hope to transplant into the bend of the left elbow of the child referred to a large piece of skin, and so give nearly natural pliancy to the part. I endeavoured to do so on the right, but failed, because I tried to transplant on to the new raw surface; and though the piece of skin appeared at first to be likely to unite, immediately suppuration commenced it came away. The fear of failure in grafting large pieces of skin is, that some points may not adhere, in consequence of pus being formed from the granulations below, and burrowing under and separating in part or whole the transplanted skin. I do not mean that grafting will ever be a substitute for plastic operations; it cannot, since the skin in the former does not retain all its natural character, as in the latter, but it will prove most valuable where plastic operations cannot advantageously be adopted.

Another field of usefulness is open to skin-grafting in cases of severe lacerated wounds needing partial amputation, or involving considerable sloughing; where the prospect of being able to transplant when granulation is fairly established, will enable us to save more of valuable parts than we should otherwise have ventured to leave uncovered by any skin, trusting alone to granulation. Such a case was recently admitted into the Bristol Infirmary. A man had his fingers and hand severely crushed and lacerated by cog-wheels, the skin in rags, the muscle mashed, and the metacarpal bones comminuted. The thumb was uninjured, and I amputated through the middle of the palm, pinching off the bones near the carpo-metacarpal joints. There was no skin to form a covering, and some sloughing of the soft parts has followed; but granulation has commenced, and, when it is fairly established, by transplanting on to the palm, and the surface covering the ends of the bones, I shall be able to materially hasten recovery and give a firmer, harder, more yielding surface for use. In retraction of stumps leaving bones covered with granulations only, transplantation of skin will be of great service, and will doubtless save some secondary amputations. Finally, following the example of Mr. Durham, of Guy's Hospital, by modification of skin-grafting, we shall be enabled to remove, with boldness, tumours involving the loss of much integument.

Another great benefit to be derived from transplantation is that of arresting the breaking down of large cicatrices. This has just been illustrated in the case of J. Dando, already mentioned. On November 30th, an ulcer formed in a large healed surface of thin cicatrix midway between the sound skin and the grafts. On December 2nd, I planted two portions of skin of the size of a pea upon this oblong surface. One, the lower, lived, and, on December 6th, was becoming red; and had stimulated fine blue cicatrization from the margin to cover half its surrounding ulcer; while the upper had died and ulcerated the surface on which it was planted, and was increased to fully a third larger. On this, and also on another ulcer which had formed, I planted a piece of skin of the size of a fourpenny-piece.

With regard to the source from which integument should be taken, most prefer the inner side of the upper arm; but one important feature of the operation is that it gives freedom of removal from any part or any person, and our endeavour should be to gain integument of the same consistence as that belonging to the part on which we plant it, while we are careful not to produce tension in the part from which we remove skin. But we are not confined to our patient even; an amputation giving healthy skin affords an abundant supply. Mr. Leonard and I both made use lately of this source from a leg amputated by Mr. Tibbits. Mr. Leonard's grafts took, but mine failed, owing to the unhealthy character of the ulcer—a syphilo-strumous ulcer covered with aplastic lymph. I was anxious to try skin from such a source, and scraped the lymph from several granulations; though the soil was unsuitable, some grafts adhered for a time, and gave assurance that they would have succeeded in a healthy ulcer. I have since employed healthy skin from an amputated limb in three cases.

Patients in a hospital are under the control of their surgeons to a degree unknown beyond its walls, and the interest elicited in their cases when such a novel plan of treatment is adopted encourages them to put up with pain and wounds where others would require firm promise of success; therefore there will be many gentlemen who will read of successes, and, owing to distance from hospitals, will be unable to witness results, which they are anxious to behold and to urge upon unwilling patients. Moreover, we have yet to prove the stability of these cicatrices; therefore I am sure that, should the surgical staff of the Plymouth Hospital systematically carry out a series of skin-transplantations for the next seven months, so as to be able to show every stage, from graftings two days old to cicatrices of large size, which have stood hard work for six months, they will, on the occasion of the annual meeting of the Association in August 1871, alike rivet the attention of numerous visitors in their wards, and help to establish the reputation of an operation which, though simple, must prove to be one of the most valuable discoveries of the nineteenth century.

ON THE TRANSMISSION OF THE INFECTION OF FEVERS BY MEANS OF FLUIDS.*

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It was for too long in the world's history the opinion that the atmosphere was exclusively the medium concerned in the transmission of epidemic diseases, and that the air surrounding the sick was the only nidus in which the infectious element might nestle and fructify, and diffuse itself from place to place, and from man to man. When the Hindoo, on an outbreak of cholera in his native village, looked with suspicion on his water-supply, and would fain attribute the origin of the disease to a poisoning of his tanks or water-courses through the agency of evil spirits or malevolence, in one respect, in regard to the etiology of the pestilence, he was in advance of medical knowledge in Europe up to a certain epoch. His experience, it is true, had been greater than ours; and, though not extending over more than two generations, it had been mighty and continuous; whereas ours had been exceptional and interrupted. But a rude generalisation from the phenomena observed in successive outbreaks had impressed him with the suspicion that the drinking of impure water was somehow one of the sources of the pestilence.

During the enlightened medical experience of these later years, the problem of the modes of communication of cholera has been wrought almost to a demonstration. The results of most of the special investigations which have been officially conducted by governments, as well as the evidence afforded by private medical inquiry, have consolidated the basis of those principles first enunciated with so much patience and truthfulness by that gifted pioneer in sanitary science, the late Dr. Snow—viz., that the elements of contagion reside chiefly in the fluid discharges of cholera, and that the great medium by which the disease is propagated is the drinking-water contaminated by these excretions. These propositions may be held to have been proven by the soundest of all processes of reasoning, the analytical; and each successive outbreak since 1849 has afforded additional data to substantiate them.

If it be accepted, then, that water is capable of holding and maintaining in activity the specific contagious principles cast out by the bowel-discharges of cholera, and that it moreover may be the means of conveying that disease, by being swallowed, to the healthy, analogy would forbid us to disbelieve that water may be the medium by which are transmitted the contagious *exuvia* of other diseases which possess the similar typical property of generating a contagious principle in the intestinal surface, or on other surfaces of the body. When we are told, therefore, that in enteric fever the specific virus of that disease is eliminated in the intestinal discharges, a similitude in this respect, with certain limitations, is approximated between that disease and cholera; and the value of the inference, that the means by which both the poisons may be transmitted shall be similar, depends on the degree of importance which we are inclined to attach to analogical reasoning on such questions. But, as might be expected in a so well studied disease as enteric fever, facts and observations have so accumulated as to have allowed the induction of general propositions, applicable to practice, of its modes of propagation and transmission. Thus it has been determined that the causation of this fever is essentially to be sought for in the emanations from house-drainage, in sewage, and in certain forms of putrefying animal matter, which produce the disease, according to one view, from being merely the recipient of the infectious excreta of some previous fever-patient; or, according to another view, from the spontaneous generation of the poison by peculiar fermentation in the decomposing matter itself. I will not pause to discuss this question; but I feel constrained to admit the possibility of the spontaneity of generation of fever, from, besides other reasons, the recognition of some undoubted instances in isolated houses in the country, originating under circumstances which seemed to preclude previous contagion from the sick.

In regard to the contagium of infectious diseases, there are two channels through which it may diffuse itself to those exposed to its action. These are, first, transmission by inhalation; and second, transmission by swallowing. By these two ways—in the one case air, and in the other ingesta—are the vehicles by means of which the morbid principle is carried into the body. Transmission by the air is doubtless infinitely the most frequent mode by which these so-called poison-germs are propagated. The atmosphere which supports our being, and which pervades in us and around us on every side, is immeasurably the most abundant natural medium or recipient of volatile emanations, which property of volatility and diffusibility we presume to be an endowment

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